

WHAT IS CLAIMED IS:

1. A color conversion coefficient preparation apparatus for preparing color conversion coefficients to
5 convert n color values including black in a first machine-dependent color space into n color values including black in a second machine-dependent color space, the color conversion coefficient preparation apparatus comprising:

10 a first TRC preparation section for preparing a color conversion coefficient for each color to convert the n color values in the first machine-dependent color space into n color values in a first adjustment-machine-dependent color space with adjusted gradation of a single color in the first machine-dependent color space;

15 a second TRC preparation section for preparing a color conversion coefficient for each color to convert n color values in a second adjustment-machine-dependent color space with adjusted gradation of a single color in the second machine-dependent color space into the n color values in the
20 second machine-dependent color space; and

a K preservation n-dimensional DLUT preparation section for preparing an n-dimensional lookup table for converting the n color values in the first adjustment-machine-dependent color space into the n color values in the second adjustment-
25 machine-dependent color space with the characteristic of black

preserved.

2. A color conversion coefficient preparation apparatus for preparing color conversion coefficients to
5 convert n color values including black in a first machine-dependent color space into n color values including black in a second machine-dependent color space, the color conversion coefficient preparation apparatus comprising:

10 a first TRC preparation section for preparing a color conversion coefficient for each color to convert the n color values in the first machine-dependent color space into n color values in a first adjustment-machine-dependent color space with adjusted gradation of a single color in the first machine-dependent color space; and

15 a K preservation n-dimensional DLUT preparation section for preparing an n-dimensional lookup table for converting the n color values in the first adjustment-machine-dependent color space into the n color values in the second machine-dependent color space with the characteristic of black preserved.

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3. A color conversion coefficient preparation apparatus for preparing color conversion coefficients to
convert n color values including black in a first machine-dependent color space into n color values including black in
25 a second machine-dependent color space, the color conversion

coefficient preparation apparatus comprising:

5 a second TRC preparation section for preparing a color conversion coefficient for each color to convert n color values in a second adjustment-machine-dependent color space with adjusted gradation of a single color in the second machine-dependent color space into the n color values in the second machine-dependent color space; and

10 a K preservation n-dimensional DLUT preparation section for preparing an n-dimensional lookup table for converting the n color values in the first machine-dependent color space into the n color values in the second adjustment-machine-dependent color space with the characteristic of black preserved.

4. A color conversion coefficient preparation apparatus for preparing color conversion coefficients to
15 convert n color values including black in a first machine-dependent color space into n color values including black in a second machine-dependent color space, the color conversion coefficient preparation apparatus comprising:

20 a first TRC preparation section for preparing a color conversion coefficient for each color to convert the n color values in the first machine-dependent color space into n color values in a first adjustment-machine-dependent color space with adjusted gradation of a single color in the first
25 machine-dependent color space;

a second TRC preparation section for preparing a color
 conversion coefficient for each color to convert n color values
 in a second adjustment-machine-dependent color space with
 adjusted gradation of a single color in the second
 5 machine-dependent color space into the n color values in the
 second machine-dependent color space;

a K conversion LUT preparation section for preparing a
 one-dimensional lookup table for converting the value of black
 in the first adjustment-machine-dependent color space into the
 10 value of black in the second adjustment-machine-dependent
 color space with the characteristic of the value of black
 preserved; and

an n-dimensional DLUT preparation section for preparing
 an n-dimensional lookup table for converting the n color values
 15 in the first adjustment-machine-dependent color space into the
 (n-1) color values except for black in the second
 adjustment-machine-dependent color space.

5. A color conversion coefficient preparation
 20 apparatus for preparing color conversion coefficients to
 convert n color values including black in a first machine-
 dependent color space into n color values including black in
 a second machine-dependent color space, the color conversion
 coefficient preparation apparatus comprising:

25 a first TRC preparation section for preparing a color

convert n color values including black in a first machine-dependent color space into n color values including black in a second machine-dependent color space, the color conversion coefficient preparation apparatus comprising

5 a first TRC preparation section for preparing a color conversion coefficient for each color except black to convert the (n-1) color values except for black in the first machine-dependent color space into (n-1) color values except for black in a first adjustment-machine-dependent color space
10 with adjusted gradation of a single color in the first machine-dependent color space;

a K conversion LUT preparation section for preparing a one-dimensional lookup table for converting the value of black in the first machine-dependent color space into the value of
15 black in the second machine-dependent color space with the characteristic of the value of black preserved; and

an n-dimensional DLUT preparation section for preparing an n-dimensional lookup table for converting the (n-1) color values except for black in the first adjustment-machine-
20 dependent color space and the value of black in the first machine-dependent color space into the (n-1) color values except for black in the second machine-dependent color space.

8. A color conversion coefficient preparation
25 apparatus for preparing color conversion coefficients to

convert n color values including black in a first machine-dependent color space into n color values including black in a second machine-dependent color space, the color conversion coefficient preparation apparatus comprising:

5 a second TRC preparation section for preparing a color conversion coefficient for each color to convert n color values in a second adjustment-machine-dependent color space with adjusted gradation of a single color in the second machine-dependent color space into the n color values in the
10 second machine-dependent color space;

a K conversion LUT preparation section for preparing a one-dimensional lookup table for converting the value of black in the first machine-dependent color space into the value of black in the second adjustment-machine-dependent color space
15 with the characteristic of the value of black preserved; and

an n-dimensional DLUT preparation section for preparing an n-dimensional lookup table for converting the n color values in the first machine-dependent color space into the (n-1) color values except for black in the second adjustment-machine-
20 dependent color space.

9. A color conversion coefficient preparation apparatus for preparing color conversion coefficients to convert n color values including black in a first machine-
25 dependent color space into n color values including black in

a second machine-dependent color space, the color conversion coefficient preparation apparatus comprising:

5 a K conversion LUT preparation section for preparing a one-dimensional lookup table for converting the value of black in the first machine-dependent color space into the value of black in the second machine-dependent color space with the characteristic of the value of black preserved; and

10 an n-dimensional DLUT preparation section for preparing an n-dimensional lookup table for converting the n color values in the first machine-dependent color space into the (n-1) color values except for black in the second machine-dependent color space.

15 10. The color conversion coefficient preparation apparatus according to claim 4,

wherein the K conversion LUT preparation section prepares a one-dimensional lookup table for converting from the value of black in the first machine-dependent color space or the first adjustment-machine-dependent color space into the value of black in the second machine-dependent color space; and

20 the second TRC preparation section prepares a color conversion coefficient for each color of the (n-1) colors except black.

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11. The color conversion coefficient preparation apparatus according to claim 1,

wherein the K preservation n-dimensional DLUT preparation section comprises:

- 5 a color specification value prediction section for predicting a color specification vector in a machine-independent color space from the n color values in the first machine-dependent color space or the first adjustment-machine-dependent color space;
- 10 a K conversion section for converting the value of black in the first machine-dependent color space or the first adjustment-machine-dependent color space into the value of black in the second machine-dependent color space or the second adjustment-machine-dependent color space with the characteristic of the value of black preserved; and
- 15 an (n-1) color prediction section for predicting (n-1) color values except for black in the second machine-dependent color space or the second adjustment-machine-dependent color space from the color specification vector in the machine-independent color space predicated by the color specification value prediction section and the value of black provided by the K conversion section.
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12. A color conversion coefficient preparation apparatus for preparing color conversion coefficients to convert n color values including black in a first machine-dependent color space into n color values including black in a second machine-dependent color space, the color conversion coefficient preparation apparatus comprising a K preservation n-dimensional DLUT preparation section for preparing an n-dimensional lookup table for converting the n color values in the first machine-dependent color space into the n color values in the second machine-dependent color space with the characteristic of black preserved,

wherein the K preservation n-dimensional DLUT preparation section comprises:

a color specification value prediction section for predicting a color specification vector in a machine-independent color space from the n color values in the first machine-dependent color space;

a K conversion section for converting the value of black in the first machine-dependent color space into the value of black in the second machine-dependent color space with the characteristic of the value of black preserved; and

an (n-1) color prediction section for predicting (n-1) color values except for black in the second machine-dependent color space from the color

specification vector in the machine-independent color space predicated by the color specification value prediction section and the value of black provided by the K conversion section.

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13. The color conversion coefficient preparation apparatus according to claim 11,

wherein the K conversion section comprises:

10 a first K characteristic calculation section for calculating a relationship with lightness, reflectivity, or density corresponding to the single color of black in the first machine-dependent color space or the first adjustment-machine-dependent color space;

15 a second K characteristic calculation section for calculating a relationship with lightness, reflectivity, or density corresponding to the single color of black in the second machine-dependent color space or the second adjustment-machine-dependent color space;

20 a K preservation K conversion LUT preparation section for preparing a one-dimensional lookup table for converting the value of black in the first machine-dependent color space or the first
25 adjustment-machine-dependent color space into the

FIG. 10

value of black in the second machine-dependent color space or the second adjustment-machine-dependent color space having a characteristic equal to or similar to that of the value of black by using the relationship calculated by the first K characteristic calculation section and the relationship calculated by the second K characteristic calculation section; and

a K preservation K conversion LUT application section for converting the value of black in the first machine-dependent color space or the first adjustment-machine-dependent color space into the value of black in the second machine-dependent color space or the second adjustment-machine-dependent color space by using the one-dimensional lookup table prepared in the K preservation K conversion LUT preparation section.

14. The color conversion coefficient preparation apparatus according to claim 13, wherein the K conversion section further comprises a K correction section for correcting the value of black provided by the K preservation K conversion LUT application section based on the n color values in the second machine-dependent color space or the second adjustment-machine-dependent color space.

color space; and

5 a K preservation K conversion LUT preparation
section for preparing a one-dimensional lookup table
for converting the value of black in the first
machine-dependent color space or the first
adjustment-machine-dependent color space into the
value of black in the second machine-dependent color
space or the second adjustment-machine-dependent
color space having a characteristic equal to or similar
10 to that of the value of black by using the relationship
calculated by the first K characteristic calculation
section and the relationship calculated by the second
K characteristic calculation section.

15 17. The color conversion coefficient preparation
apparatus according to claim 1, wherein the second TRC
preparation section prepares a one-dimensional lookup table
for executing inverse conversion to conversion from the values
in the second machine-dependent color space to values in the
20 second adjustment-machine-dependent color space for each of
the n color values or the (n-1) color values except for black.

25 18. The color conversion coefficient preparation
apparatus according to claim 1, wherein the first TRC
preparation section, the second TRC preparation section, or

the K preservation n-dimensional DLUT preparation section prepares a one-dimensional lookup table or an n-dimensional lookup table as the color conversion coefficient so that the under color of paper becomes white.

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19. The color conversion coefficient preparation apparatus according to claim 1 further comprising n-dimensional DLUT reset section for forcibly replacing with predetermined values, data of n colors, (n-1) colors, (n-2) colors, or (n-m) colors that a specific grid point, grid points on a specific line, grid points on a specific plane, or grid points on a specific m-dimensional area of the n-dimensional lookup table prepared by said K preservation n-dimensional DLUT preparation section have.

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20. The color conversion coefficient preparation apparatus according to claim 19, wherein the n-dimensional DLUT reset section forcibly sets to all 0, the data of the n colors that the grid point with the n color values being all 0 corresponding to address data of the n-dimensional lookup table has.

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21. The color conversion coefficient preparation apparatus according to claim 19, wherein the n-dimensional DLUT reset section forcibly sets to all 0, the data of black that

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the grid point with the value of black being 0 corresponding to address data of the n-dimensional lookup table has.

22. The color conversion coefficient preparation apparatus according to claim 19, wherein the n-dimensional DLUT reset section forcibly sets to all 0, the data of the (n-1) colors except black that the grid point with the values of the (n-1) colors except black being all 0 corresponding to address data of the n-dimensional lookup table has.

23. The color conversion coefficient preparation apparatus according to claim 19, wherein the n-dimensional DLUT reset section forcibly sets to all 0, the data of the (n-1) colors other than a specific color that the grid point with the values of the (n-1) colors except the specific color other than black being 0 corresponding to address data of the n-dimensional lookup table has.

24. The color conversion coefficient preparation apparatus according to claim 19, wherein the n-dimensional DLUT reset section forcibly sets to all 0, the data of two colors that the grid point of secondary color with the values of the two colors being 0 corresponding to address data of the n-dimensional lookup table has.

25. The color conversion coefficient preparation apparatus according to claim 19 further comprising a user interface for enabling a user to set an item to be reset by the n-dimensional DLUT reset section.

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26. The color conversion coefficient preparation apparatus according to claim 19, wherein the n-dimensional DLUT reset section further makes a re-determination so that data of any other color except for the color forcibly replaced with the predetermined value becomes roughly equivalent to representation color before forcible replacement with the predetermined value.

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27. The color conversion coefficient preparation apparatus according to claim 26, wherein the n-dimensional DLUT reset section forcibly sets to all 0, the data of black that the grid point with the value of black being 0 corresponding to address data of the n-dimensional lookup table has; and

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the n-dimensional DLUT reset section makes a re-determination so that data of any other color than black becomes roughly equivalent to representation color before the value of black is set to 0.

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28. The color conversion coefficient preparation apparatus according to claim 26, wherein the n-dimensional DLUT

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reset section forcibly sets to all 0, the data of the (n-1) colors except black that the grid point with the values of the (n-1) colors except black being all 0 corresponding to address data of the n-dimensional lookup table has; and

5 the n-dimensional DLUT reset section makes a re-determination so that black becomes roughly equivalent to representation color before the values of the (n-1) colors except black are set to 0.

10 29. The color conversion coefficient preparation apparatus according to claim 26, wherein the n-dimensional DLUT reset section forcibly sets to all 0, the data of the (n-1) colors other than a specific color that the grid point with the values of the (n-1) colors except the specific color other
15 than black being all 0 corresponding to address data of the n-dimensional lookup table has; and

 the n-dimensional DLUT reset section makes a re-determination so that data of the specific colors other than black becomes roughly equivalent to representation color
20 before the values of the (n-1) colors are set to 0.

 30. The color conversion coefficient preparation apparatus according to claim 26, wherein the n-dimensional DLUT reset section forcibly sets to all 0, the data of two colors
25 that the grid point of secondary color with the values of the

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two colors being 0 corresponding to address data of the n-dimensional lookup table has; and

the n-dimensional DLUT reset section makes a re-determination so that data of (n-2) colors other than the two
5 colors whose values are forcibly set to all 0 becomes roughly equivalent to representation color before the data of the two colors are forcibly set to all 0.

31. The color conversion coefficient preparation
10 apparatus according to claim 1, wherein the first TRC preparation section, the second TRC preparation section, and the K preservation n-dimensional DLUT preparation section use colorimetric values of color charts printed by a first machine and a second machine.

15 32. The color conversion coefficient preparation apparatus according to claim 1, wherein the first TRC preparation section, the second TRC preparation section, and the K preservation n-dimensional DLUT preparation section use
20 color values prepared from conversion definition previously prepared corresponding to a first machine and a second machine.

33. The color conversion coefficient preparation
25 apparatus according to claim 1 wherein at least the K preservation n-dimensional DLUT preparation section or the

n-dimensional DLUT preparation section uses colorimetric values of color charts printed by a first machine and color values prepared from conversion definition previously prepared corresponding to a second machine.

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34. The color conversion coefficient preparation apparatus according to claim 1, wherein at least the K preservation n-dimensional DLUT preparation section or the n-dimensional DLUT preparation section uses color values prepared from conversion definition previously prepared corresponding to a first machine and colorimetric values of color charts printed by a second machine.

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35. The color conversion coefficient preparation apparatus according to claim 1, wherein the n colors are four colors of black, cyan, magenta, and yellow.

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36. A computer-readable storage medium storing a program for:

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preparing a color conversion coefficient for each color to convert n color values in a first machine-dependent color space into n color values in a first adjustment-machine-dependent color space with adjusted gradation of a single color in the first machine-dependent color space;

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preparing a color conversion coefficient for each color

gradation of a single color in the first machine-dependent color space to n color values including black that each pixel of an input color image has;

5 a K preservation n-dimensional DLUT application section for applying the n-dimensional lookup table for converting the n color values in the first adjustment-machine-dependent color space provided by the first TRC application section into n color values in a second adjustment-machine-dependent color space with the characteristic of black preserved to the n color values
10 in the first adjustment-machine-dependent color space provided by the first TRC application section; and

a second TRC application section for executing conversion by applying a color conversion coefficient prepared for each color for converting n color values in the second
15 adjustment-machine-dependent color space with adjusted gradation of a single color in a second machine-dependent color space into n color values in the second machine-dependent color space to the n color values provided by the K preservation n-dimensional DLUT application section.

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38. A color conversion system for executing color conversion processing using a one-dimensional lookup table and an n-dimensional lookup table prepared in a color conversion coefficient preparation apparatus according to claim 2, the
25 color conversion system comprising:

a first TRC application section for executing conversion by applying a color conversion coefficient prepared for each color for converting n color values in a first machine-dependent color space into n color values in a first adjustment-machine-dependent color space with adjusted gradation of a single color in the first machine-dependent color space to n color values including black that each pixel of an input color image has; and

a K preservation n-dimensional DLUT application section for applying the n-dimensional lookup table for converting the n color values in the first adjustment-machine-dependent color space provided by the first TRC application section into n color values in a second machine-dependent color space with the characteristic of K preserved to the n color values in the first adjustment-machine-dependent color space provided by the first TRC application section.

39. A color conversion system for executing color conversion processing using a one-dimensional lookup table and an n-dimensional lookup table prepared in a color conversion coefficient preparation apparatus according to claim 3, the color conversion system comprising:

a K preservation n-dimensional DLUT application section for applying the n-dimensional lookup table for converting n color values in the first machine-dependent color space into

n color values in a second adjustment-machine-dependent color space with the characteristic of K preserved to the n color values including black that each pixel of an input color image has; and

5 a second TRC application section for executing conversion by applying a color conversion coefficient prepared for each color for converting n color values in the second adjustment-machine-dependent color space with adjusted gradation of a single color in a second machine-dependent color space into n color values in the second machine-dependent color space to the n color values provided by the K preservation n-dimensional DLUT application section.

10 40. A color conversion system for executing color conversion processing using a one-dimensional lookup table and an n-dimensional lookup table prepared in a color conversion coefficient preparation apparatus according to claim 4, the color conversion system comprising:

15 a first TRC application section for executing conversion by applying a color conversion coefficient prepared for each color for converting n color values in a first machine-dependent color space into n color values in a first adjustment-machine-dependent color space with adjusted gradation of a single color in the first machine-dependent color space to n color values including black that each pixel

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of an input color image has;

5 a K conversion LUT application section for applying the one-dimensional lookup table for converting the value of black in the first adjustment-machine-dependent color space into the value of black in a second adjustment-machine-dependent color space with the characteristic of the value of black preserved to the value of black in the first adjustment-machine-dependent color space provided by the first TRC application section;

10 an n-dimensional DLUT application section for applying the n-dimensional lookup table for converting the n color values in the first adjustment-machine-dependent color space provided by the first TRC application section into (n-1) color values except for black in the second adjustment-machine-dependent color space to the n color values in the first adjustment-machine-dependent color space provided by the first TRC application section; and

15 a second TRC application section for executing conversion by applying a color conversion coefficient prepared for each color for converting n color values in the second adjustment-machine-dependent color space with adjusted gradation of a single color in a second machine-dependent color space into n color values in the second machine-dependent color space to the (n-1) color values except for black provided by the n-dimensional DLUT application section and the value of black provided by the K conversion LUT application section.

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adjustment-machine-dependent color space with adjusted gradation of a single color in the first machine-dependent color space to n color values including black that each pixel of an input color image has;

5 a K conversion LUT application section for applying the one-dimensional lookup table for converting the value of black in the first adjustment-machine-dependent color space into the value of black in a second adjustment-machine-dependent color space with the characteristic of the value of black preserved
10 to the value of black in the first adjustment-machine-dependent color space provided by the first TRC application section; and

an n-dimensional DLUT application section for applying the n-dimensional lookup table for converting the n color values in the first adjustment-machine-dependent color space
15 into (n-1) color values except for black in the second machine-dependent color space to the n color values in the first adjustment-machine-dependent color space provided by the first TRC application section.

20 43. A color conversion system for executing color conversion processing using a one-dimensional lookup table and an n-dimensional lookup table prepared in a color conversion coefficient preparation apparatus according to claim 7, the color conversion system comprising:

25 a first TRC application section for executing conversion

by applying a color conversion coefficient prepared for each color for converting (n-1) color values except for black in a first machine-dependent color space into (n-1) color values except for black in a first adjustment-machine-dependent color space with adjusted gradation of a single color in the first machine-dependent color space to (n-1) color values except for black of n color values including black that each pixel of an input color image has;

a K conversion LUT application section for applying the one-dimensional lookup table for converting the value of black in the first machine-dependent color space into the value of black in a second machine-dependent color space with the characteristic of the value of black preserved to the value of black that each pixel of the input color image has; and

an n-dimensional DLUT application section for applying the n-dimensional lookup table for converting the (n-1) color values except for black in the first adjustment-machine-dependent color space and the value of black in the first machine-dependent color space into (n-1) color values except for black in the second machine-dependent color space to the (n-1) color values except for black in the first adjustment-machine-dependent color space provided by the first TRC application section and the value of black that each pixel of the input color image has.

the n-dimensional DLUT application section and the value of black provided by the K conversion LUT application section.

45. A color conversion system for executing color
5 conversion processing using a one-dimensional lookup table and an n-dimensional lookup table prepared in a color conversion coefficient preparation apparatus according to claim 9, the color conversion system comprising:

an n-dimensional DLUT application section for applying
10 the n-dimensional lookup table for converting n color values in the first machine-dependent color space into (n-1) color values except for black in a second machine-dependent color space to n color values including black that each pixel of an input color image has; and

15 a K conversion LUT application section for applying the one-dimensional lookup table for converting the value of black in the first machine-dependent color space into the value of black in a second machine-dependent color space with the characteristic of the value of black preserved to the value
20 of black that each pixel of the input color image has.

46. The color conversion system according to claim 40,
wherein the K conversion LUT application section applies the one-dimensional lookup table for converting from the value of
25 black in the first machine-dependent color space or the first

source device;

a second source side input section for inputting a plurality of data sets to prepare color characteristic information of the source device;

5 a first target side input section for inputting previously stored color characteristic information of the target device;

10 a second target side input section for inputting a plurality of data sets to prepare color characteristic information of the target device;

a selection instruction section for selecting either the first source side input section or the second source side input section and either the first target side input section or the second target side input section; and

15 a color conversion data preparation section for preparing the color conversion data based on the color characteristic information or the data set input through either the first source side input section or the second source side input section selected through the selection instruction
20 section and the color characteristic information or the data set input through either the first target side input section or the second target side input section selected through the selection instruction section.

25 49. A color data processing apparatus for preparing

color conversion data based on characteristics of a source device and a target device, the color data processing apparatus comprising:

5 a first source side input section for inputting previously stored color characteristic information of the source device;

a second source side input section for inputting a plurality of data sets to prepare color characteristic information of the source device;

10 a target side input section for inputting previously stored color characteristic information of the target device;

a selection instruction section for selecting either the first source side input section or the second source side input section; and

15 a color conversion data preparation section for preparing the color conversion data based on the color characteristic information or the data set input through either the first source side input section or the second source side input section selected through the selection instruction
20 section and the color characteristic information input through the target side input section.

50. A color data processing apparatus for preparing color conversion data based on characteristics of a source
25 device and a target device, the color data processing apparatus

input section; and

a data processing section for performing predetermined processing for at least the plurality of data sets prepared in the source side data set preparation section.

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52. The color data processing apparatus according to claim 48 further comprising:

a target side data set preparation section for preparing a plurality of data sets in accordance with the color characteristic information input through the first target side input section; and

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a data processing section for performing predetermined processing for at least the plurality of data sets prepared in the target side data set preparation section.

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53. The color data processing apparatus according to claim 48 further comprising a color conversion execution section for performing color conversion processing for input image data by using the color conversion data prepared in the color conversion data preparation section.

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54. A computer-readable storage medium storing a program for causing a computer to execute processing of preparing color conversion data based on characteristics of a source device and a target device, the program for causing

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the computer to execute:

a first source side input step of inputting previously stored color characteristic information of the source device;

a second source side input step of inputting a plurality
5 of data sets to prepare color characteristic information of the source device;

a first target side input step of inputting previously stored color characteristic information of the target device;

a second target side input step of inputting a plurality
10 of data sets to prepare color characteristic information of the target device;

a selection instruction step of selecting either the first source side input step or the second source side input step and either the first target side input step or the second
15 target side input step; and

a color conversion data preparation step of preparing the color conversion data based on the color characteristic information or the data set input through either the first source side input step or the second source side input step
20 selected through the selection instruction step and the color characteristic information or the data set input through either the first target side input step or the second target side input step selected through the selection instruction step.

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